

Appendix A

Guide to AWS Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods

(This Appendix is not a part of AWS A5.10/A5.10M:1999, Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods, but is included for information purposes only.)

A1. Introduction

This guide is designed to correlate the filler metal classifications with their intended applications so the specification can be used more effectively. Reference to appropriate base metal alloys is made whenever that can be done and when it would be helpful. Such references are intended as examples rather than complete listings of the materials for which each filler metal is suitable.

A2. Classification System

A2.1 Both welding electrodes and rods are classified upon the basis of the chemical composition of the aluminum filler metal and a usability test. The AWS classifications used in this specification are based as follows:

A2.2 The Aluminum Association alloy designation nomenclature is used for the numerical portion to identify the alloy and thus its registered chemical composition.

A2.3 A letter prefix designates usability of the filler metal. The letter system for identifying the filler metal classifications in this specification follows the standard pattern used in other AWS filler metal specifications. The prefix "E" indicates the filler metal is suitable for use as an electrode and the prefix "R" indicates suitability as welding rod. Since some of these filler metals are used as electrodes in gas metal arc welding, and as welding rods in oxyfuel gas, gas tungsten arc, and plasma arc welding, both letters, "ER," are used to indicate suitability as an electrode or a rod. In all cases, a product which meets the test requirements for an electrode in this specification, that meets the test requirements for a welding rod, must also pass the test for an electrode before being classified as an electrode.

A2.4 An international system for designating welding filler metals is under development by the International Institute of Welding (IIW) for use in future specifications to be issued by the International Standards Organization

(ISO). Table A1 shows the proposed designations for aluminum filler metals. In that system, the initial "S" designates a solid wire or rod, the letter "A" the alloy system, followed by a four-digit number. For aluminum alloys, the four-digit number is the same as that commonly recognized worldwide, except for the cast rods, which adopt the first four digits of the UNS number (see Table A1).

A2.5 Minor changes in procedures used in the manufacture of aluminum filler metals can affect their surface quality and significantly affect the resultant weld soundness. Usability testing of the electrode is desirable on a periodic basis to assure that the product classified in this specification continues to meet the soundness requirement.

The supplier should perform the usability tests of this specification on an annual basis, as a minimum, to assure that the specified soundness and operating characteristics criteria are maintained. ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*, should be used by a purchaser for definition of lot and frequency of testing references when purchasing aluminum filler metals.

A3. Acceptance

Acceptance of all welding materials classified under this specification is in accordance with ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*, as the specification states. Any testing a purchaser requires of the supplier, for material shipped in accordance with this specification, shall be clearly stated in the purchase order, according to the provisions of ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*. In the absence of any such statement in the purchase order, the supplier may ship the material with whatever testing the supplier normally conducts on material of that classification, as specified in Schedule F, Table 1, of ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*. Testing in accordance with any other Schedule in that Table must be specifically required by the purchase order. In such cases, acceptance of the material shipped will be in accordance with those requirements.

TABLE 2
REQUIRED TESTS

AWS Classification	Chemical Analysis	Radiographic Test ^a (Electrode)	Bead-On-Plate Test (Rod)
ER1100	X	X	—
R1100	X	—	X
ER1188	X	X	—
R1188	X	—	X
ER2319	X	X	—
R2319	X	—	X
ER4009	X	X	—
R4009	X	—	X
ER4010	X	X	—
R4010	X	—	X
R4011	X	—	X
X ER4043	X	X	—
R4043	X	—	X
ER4047	X	X	—
R4047	X	—	X
ER4145	X	X	—
R4145	X	—	X
ER4643	X	X	—
R4643	X	—	X
ER5183	X	X	—
R5183	X	—	X
ER5356	X	X	—
R5356	X	—	X
ER5554	X	X	—
R5554	X	—	X
ER5556	X	X	—
R5556	X	—	X
ER5654	X	X	—
R5654	X	—	X
R-206.0	X	—	X
R-C355.0	X	—	X
R-A356.0	X	—	X
R-357.0	X	—	X
R-A357.0	X	—	X

NOTE:

- a. Filler metal meeting the radiographic requirement, when tested as an electrode, is not required to be tested as a rod, as specified in 9.2.

TABLE 1
CHEMICAL COMPOSITION REQUIREMENTS FOR ALUMINUM ELECTRODES AND RODS

Weight Percent ^{a,b}													
AWS Classification	UNS Number ^c	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Other Elements		
											Each	Total	Al
ER1100	A91100	d	d	0.05-0.20	0.05	—	—	—	0.10	—	0.05 ^e	0.15	99.0 min ^f
R1100	A91100	d	d	0.05-0.20	0.05	—	—	—	0.10	—	0.05 ^e	0.15	99.0 min ^f
ER1188 ^g	A91188	0.06	0.06	0.005	0.01	0.01	—	—	0.03	0.01	0.01 ^e	—	99.88 min
R1188 ^g	A91188	0.06	0.06	0.005	0.01	0.01	—	—	0.03	0.01	0.01 ^e	—	99.88 min
ER2319 ^h	A92319	0.20	0.30	5.8-6.8	0.20-0.40	0.02	—	—	0.10	0.10-0.20	0.05 ^e	0.15	Remainder
R2319 ^h	A92319	0.20	0.30	5.8-6.8	0.20-0.40	0.02	—	—	0.10	0.10-0.20	0.05 ^e	0.15	Remainder
ER4009	A94009	4.5-5.5	0.20	1.0-1.5	0.10	0.45-0.6	—	—	0.10	0.20	0.05 ^e	0.15	Remainder
R4009	A94009	4.5-5.5	0.20	1.0-1.5	0.10	0.45-0.6	—	—	0.10	0.20	0.05 ^e	0.15	Remainder
ER4010	A94010	6.5-7.5	0.20	0.20	0.10	0.30-0.45	—	—	0.10	0.20	0.05 ^e	0.15	Remainder
R4010	A94010	6.5-7.5	0.20	0.20	0.10	0.30-0.45	—	—	0.10	0.20	0.05 ^e	0.15	Remainder
R4011 ^k	A94011	6.5-7.5	0.20	0.20	0.10	0.45-0.7	—	—	0.10	0.04-0.20	0.05	0.15	Remainder
ER4043	A94043	4.5-6.0	0.8	0.30	0.05	0.05	—	—	0.10	0.20	0.05 ^e	0.15	Remainder
R4043	A94043	4.5-6.0	0.8	0.30	0.05	0.05	—	—	0.10	0.20	0.05 ^e	0.15	Remainder
ER4047	A94047	11.0-13.0	0.8	0.30	0.15	0.10	—	—	0.20	—	0.05 ^e	0.15	Remainder
R4047	A94047	11.0-13.0	0.8	0.30	0.15	0.10	—	—	0.20	—	0.05 ^e	0.15	Remainder
ER4145	A94145	9.3-10.7	0.8	3.3-4.7	0.15	0.15	0.15	—	0.20	—	0.05 ^e	0.15	Remainder
R4145	A94145	9.3-10.7	0.8	3.3-4.7	0.15	0.15	0.15	—	0.20	—	0.05 ^e	0.15	Remainder
ER4643	A94643	3.6-4.6	0.8	0.10	0.05	0.10-0.30	—	—	0.10	0.15	0.05 ^e	0.15	Remainder
R4643	A94643	3.6-4.6	0.8	0.10	0.05	0.10-0.30	—	—	0.10	0.15	0.05 ^e	0.15	Remainder
ER5183	A95183	0.40	0.40	0.10	0.50-1.0	4.3-5.2	0.05-0.25	—	0.25	0.15	0.05 ^e	0.15	Remainder
R5183	A95183	0.40	0.40	0.10	0.50-1.0	4.3-5.2	0.05-0.25	—	0.25	0.15	0.05 ^e	0.15	Remainder
ER5356	A95356	0.25	0.40	0.10	0.05-0.20	4.5-5.5	0.05-0.20	—	0.10	0.06-0.20	0.05 ^e	0.15	Remainder
R5356	A95356	0.25	0.40	0.10	0.05-0.20	4.5-5.5	0.05-0.20	—	0.10	0.06-0.20	0.05 ^e	0.15	Remainder
ER5554	A95554	0.25	0.40	0.10	0.50-1.0	2.4-3.0	0.05-0.20	—	0.25	0.05-0.20	0.05 ^e	0.15	Remainder
R5554	A95554	0.25	0.40	0.10	0.50-1.0	2.4-3.0	0.05-0.20	—	0.25	0.05-0.20	0.05 ^e	0.15	Remainder
ER5556	A95556	0.25	0.40	0.10	0.50-1.0	4.7-5.5	0.05-0.20	—	0.25	0.05-0.20	0.05 ^e	0.15	Remainder
R5556	A95556	0.25	0.40	0.10	0.50-1.0	4.7-5.5	0.05-0.20	—	0.25	0.05-0.20	0.05 ^e	0.15	Remainder

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